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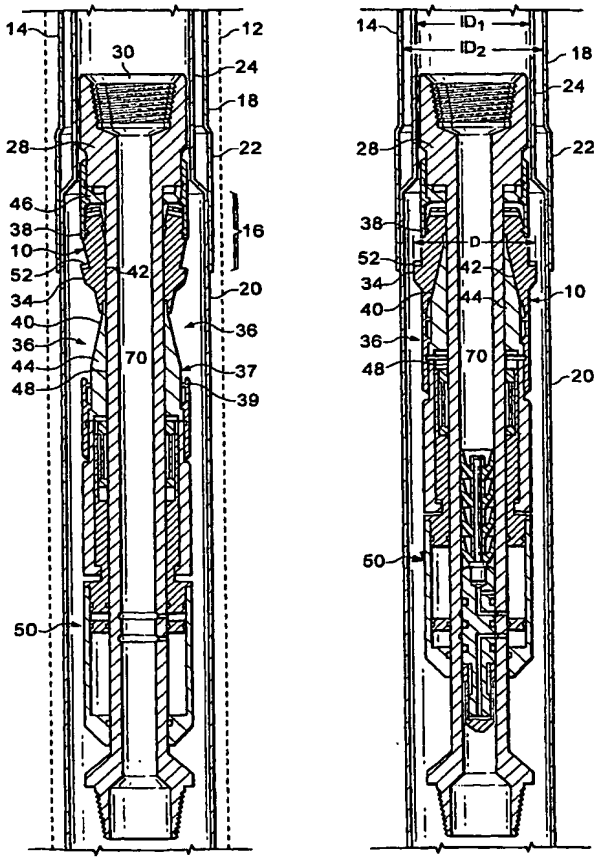
[Continued on next page]

(54) Title: CUTTER FOR WELLBORE CASING



(57) Abstract: A cutter (10) for a wellbore casing (20) is provided that includes a rotatable tubular support (28), at least one cutter blade (34) supported on the rotatable tubular support, having a retracted position for insertion into the wellbore casing and having an expanded position for cutting engagement with the wellbore casing, and an actuator (50) for moving the cutter blade from the retracted position to the expanded position for cutting engagement with the wellbore casing.

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AMENDED CLAIMS
[received by the International Bureau on 25 August 2004 (25.08.04);
original claims 11-12, 17-18 amended; claims 19-43 added
remaining claims unchanged (8 pages)]

position to the expanded position further comprises means for selectively activating the actuator to move the cutter blades from the retracted position to the expanded position for cutting engagement with the wellbore casing and from the expanded position to the retracted position.

8. The cutter tool of claim 7, wherein the actuator comprises a hydraulic cylinder attached to the tubular support and coupled to the expander device, the hydraulic cylinder having an opening chamber for moving the cone in an axial direction for expanding the cutter blades and having a closing cylinder for moving the expander cone in an opposite axial direction for retracting the cutter blade and wherein the activation device comprises a first activation dart seatable in the tubular support for directing fluidic material into the opening chamber of the hydraulic cylinder and a second activation dart seatable in the tubular support for directing fluidic material into the closing chamber of the hydraulic cylinder.

9. The cutter tool of claim 4, wherein the expander cone has a plurality of first cam arms each providing one of the plurality of ramp surfaces and slidingly engaged with a separate one of the plurality of cutter blades and further comprising a second cone having a plurality of cam second arms each having a second ramp surface and interleaved with the first cam arms and a plurality of dummy blades interleaved with the plurality of cutter blades and in sliding engagement with the second ramp surfaces provided on the second cam arms, the dummy blades expandable and retractable with the cutter blades and having insufficient thickness to contact the wellbore casing when expanded.

10. The cutter tool of claim 1, wherein the cutter blade further comprises a cutting tip secured to the cutter blade projecting radially outward when the cutter blade is in the expanded position for cutting engagement between the cutting tip and the wellbore casing .

11. A casing cutting tool, comprising:
an upper tubular support member;
an upper cam assembly comprising:
a tubular base; and
a plurality of cam arms extending from the tubular base in a downward longitudinal direction, each cam arm defining an inclined surface;
a plurality of upper cutting segments interleaved with the cam arms of the upper cam assembly and pivotally coupled to the upper tubular support member;
a lower tubular support member;
a lower cam assembly comprising:
a tubular base; and
a plurality of cam arms extending from the tubular base in an upward longitudinal

direction, each cam arm defining an inclined surface that mates with the inclined surface of a corresponding one of the upper cutter blade segments;

wherein the cams arms of the upper cam assembly are interleaved with and overlap the cam arms of the lower cam assembly; and

a plurality of lower non-cutting segments interleaved with cam arms of the lower cam assembly and the upper cutting segments, each lower non-cutting segment pivotally coupled to the lower tubular support member and mating with the inclined surface of a corresponding one of the cam arms of the upper cam assembly.

12. (Amended) A method for cutting a wellbore casing comprising :

providing a plurality of cutter blades supported on a rotatable tubular support;

placing the plurality of cutter blades in a retracted position;

inserting the tubular support into the wellbore casing with the cutter blades supported in the retracted position;

actuating the cutter blades in the wellbore to expand into a cutting position to engage with the wellbore casing; and

rotating the tubular support with the cutter blades supported thereon so that the wellbore casing is cut by the rotating cutter blades.

13. A method of radially expanding cutter blades for cutting a wellbore casing in a wellbore, comprising:

supporting the expandable tubular member using a tubular support member and an expandable cutter tool;

injecting a fluidic material into the tubular support member;

actuating the expandable cutter tool radially outwardly relative to the wellbore casing and into cutting engagement with the wellbore casing using the injected fluidic material.

14. The method of claim 13, further comprising:

rotating the expandable cutter tool in cutting engagement with the wellbore casing when the expandable cutter tool is expanded radially outwardly relative to the wellbore casing.

15. The method of claim 14, further comprising:

continuing to rotate the expandable cuter tool in cutting engagement with the wellbore casing until an upper portion of the wellbore casing is severed from the wellbore

casing;

maintaining the expandable cutter tool in the radially expanded position after the upper portion of the wellbore casing is severed; and

raising the expandable cutter tool with the severed casing portion supported thereon out of the wellbore.

16. The method of claim 13, wherein actuating the expandable cutter tool radially outwardly relative to the wellbore casing and into cutting engagement with the wellbore casing using the injected fluidic material, further comprises:

directing the fluidic material from within a portion of the tubular support member to an actuator cylinder to cause the cutting tool to slide axially on ramp surfaces so that cutting blades are moved radially outwardly.

17. The method of claim 13, wherein actuating the expandable cutter tool radially outwardly relative to the wellbore casing and into cutting engagement with the wellbore casing, wherein the tubular support member comprises:

an upper tubular support member and a lower tubular support member; and

wherein actuating the expandable cutter tool comprises displacing the upper tubular support member relative to the lower tubular support member.

18. The method of claim 17, wherein the expandable cutting tool comprises:

an upper cam assembly comprising:

a tubular base; and

a plurality of cam arms extending from the tubular base in a downward longitudinal direction, each cam arm defining an inclined surface;

a plurality of upper cutting blade segments interleaved with the cam arms of the upper cam assembly and pivotally coupled to the upper tubular support member;

a lower cam assembly comprising:

a tubular base; and

a plurality of cam arms extending from the tubular base in an upward longitudinal direction, each cam arm defining an inclined surface that mates with the inclined surface of a corresponding one of the upper cutter blade segments;

wherein the cams arms of the upper cam assembly are interleaved with and overlap the cam arms of the lower cam assembly; and

a plurality of lower dummy segments interleaved with cam arms of the lower cam

assembly and the upper cutting blade segments, each lower dummy segment pivotally coupled to the lower tubular support member and mating with the inclined surface of a corresponding one of the cam arms of the upper cam assembly.

19. A cutter tool for a tubular member, comprising:

a rotatable tubular support;

at least one cutter blade supported on the rotatable tubular support, having a retracted position for insertion into the tubular member and having an expanded position for cutting engagement with the tubular member; and

an actuator means for moving the cutter blade from the retracted position to the expanded position for cutting engagement with the tubular member.

20. The cutter tool of claim 19, further comprising an expander device means coupled to the actuator means for displacing the cutter blade outwardly; and wherein the cutter blade is pivotably mounted on the expander device means.

21. The cutter tool of claim 20, wherein the cutter blade includes an interior sliding surface and the expander device means includes a ramp surface moveable by the actuator means along the tubular support in sliding engagement with the interior sliding surface of the cutter blade to pivot the cutter blade between the retracted position and the expanded position.

22. The cutter tool of claim 21, wherein the at least one cutter blade includes a plurality of cutter blades each pivotably mounted on the expander device means and each having an interior sliding surface and wherein the expander device means comprises an expander cone means supported on a mandrel portion of the tubular support and having a plurality of ramp surfaces slidingly engaged with each interior sliding surface of the plurality of cutter blades.

23. The cutter tool of claim 22, wherein the actuator means for moving the cutter device from the retracted position to the expanded position further comprises an activation device means for selectively activating the actuator means to move the cutter blade from the retracted position to the expanded position for cutting engagement with the tubular member.

24. The cutter tool of claim 23, wherein the actuator means comprises a hydraulic cylinder attached to the tubular support and coupled to the expander device means and wherein the activation device means comprises an activation means in the tubular support for directing fluidic material into the hydraulic

cylinder to cause relative sliding movement of the expander cone on the mandrel portion of the tubular support.

25. The cutter tool of claim 22, wherein the actuator means for moving the cutter device from the retracted position to the expanded position further comprises means for selectively activating the actuator to move the cutter blades from the retracted position to the expanded position for cutting engagement with the tubular member and from the expanded position to the retracted position.

26. The cutter tool of claim 25, wherein the actuator means comprises a hydraulic cylinder attached to the tubular support and coupled to the expander device means, the hydraulic cylinder having an opening chamber for moving the cone in an axial direction for expanding the cutter blades and having a closing cylinder for moving the expander cone in an opposite axial direction for retracting the cutter blade and wherein the activation device means comprises a first activation means seatable in the tubular support for directing fluidic material into the opening chamber of the hydraulic cylinder and a second activation means seatable in the tubular support for directing fluidic material into the closing chamber of the hydraulic cylinder.

27. The cutter tool of claim 22, wherein the expander cone has a plurality of first cam arms each providing one of the plurality of ramp surfaces and slidingly engaged with a separate one of the plurality of cutter blades and further comprising a second cone having a plurality of cam second arms each having a second ramp surface and interleaved with the first cam arms and a plurality of dummy blades interleaved with the plurality of cutter blades and in sliding engagement with the second ramp surfaces provided on the second cam arms, the dummy blades expandable and retractable with the cutter blades and having insufficient thickness to contact the tubular member when expanded.

28. The cutter tool of claim 19, wherein the cutter blade further comprises a cutting tip secured to the cutter blade projecting radially outward when the cutter blade is in the expanded position for cutting engagement between the cutting tip and the tubular member.

29. A system for cutting a tubular member comprising :

means for providing a plurality of cutter blades supported on a rotatable tubular support;

means for placing the plurality of cutter blades in a retracted position;

means for inserting the tubular support into the tubular member with the cutter blades supported in the retracted position;

means for actuating the cutter blades in the tubular member to expand into a cutting position to engage with the tubular member; and

means for rotating the tubular support with the cutter blades supported thereon so that the tubular member is cut by the rotating cutter blades.

30. A system for radially expanding cutter blades for cutting a tubular member in a preexisting structure, comprising:

means for supporting the expandable tubular member using a tubular support member and an expandable cutter tool;

means for injecting a fluidic material into the tubular support member; and

means for actuating the expandable cutter tool radially outwardly relative to the tubular member and into cutting engagement with the tubular member using the injected fluidic material.

31. The system of claim 30, further comprising:

means for rotating the expandable cutter tool in cutting engagement with the tubular member when the expandable cutter tool is expanded radially outwardly relative to the tubular member.

32. The system of claim 31, further comprising:

means for continuing to rotate the expandable cuter tool in cutting engagement with the tubular member until an upper portion of the tubular member is severed from the tubular member;

means for maintaining the expandable cutter tool in the radially expanded position after the upper portion of the tubular member is severed; and

means for raising the expandable cutter tool with the severed tubular member portion supported thereon out of the preexisting structure.

33. The system of claim 30, wherein means for actuating the expandable cutter tool radially outwardly relative to the wellbore casing and into cutting engagement with the wellbore casing using the injected fluidic material, further comprises:

means for directing the fluidic material from within a portion of the tubular support member to an actuator cylinder to cause the cutting tool to slide axially on ramp surfaces so that cutting blades are moved radially outwardly.

34. The system of claim 30, wherein means for actuating the expandable cutter tool radially outwardly relative to the wellbore casing and into cutting engagement with the wellbore casing, wherein the tubular support member comprises:

an upper tubular support member and a lower tubular support member; and

wherein actuating the expandable cutter tool comprises means for displacing the upper tubular support member relative to the lower tubular support member.

35. A cutter tool for a tubular member, comprising:

a rotatable tubular support;

a plurality of cutting elements supported on the rotatable tubular support, having a retracted position for insertion into the tubular member and having an expanded position for cutting engagement with the wellbore casing;

a plurality of non-cutting elements supported on the rotatable tubular support, having a retracted position for insertion into the tubular member and having an expanded position;

an actuator for moving the cutting and non-cutting elements from the retracted positions to the expanded positions;

wherein the cutting elements are interleaved with the non-cutting elements; and

wherein, in the retracted positions, the cutting elements and the non-cutting elements are positioned away from one another in an axial direction; and

wherein in the expanded positions, the cutting elements and the non-cutting elements are brought together in the axial direction.

36. A method of cutting a tubular member, comprising:

interleaving a plurality of cutting elements with a plurality of non-cutting elements;

positioning the cutting elements and non-cutting elements within the tubular member;

rotating and translating the cutting elements and the non-cutting elements until the cutting elements engage the tubular member; and

rotating the cutting elements relative to the tubular member to cut the tubular member.

37. The method of claim 36, further comprising:

rotating and translating the cutting elements and the non-cutting elements after cutting the tubular member.

38. The method of claim 36, wherein positioning the cutting elements and non-cutting elements within the tubular member comprises:

spacing apart the cutting elements from the non-cutting elements in an axial direction.

39. The method of claim 36, wherein rotating and translating the cutting elements and the non-

cutting elements until the cutting elements engage the tubular member comprises:

moving the cutting elements towards the non-cutting elements in an axial direction; and

displacing the cutting elements and the non-cutting elements outwardly in a radial direction.

40. A system for cutting a tubular member, comprising:

means for interleaving a plurality of cutting elements with a plurality of non-cutting elements;

means for positioning the cutting elements and non-cutting elements within the tubular member;

means for rotating and translating the cutting elements and the non-cutting elements until the cutting elements engage the tubular member; and

means for rotating the cutting elements relative to the tubular member to cut the tubular member.

41. The system of claim 40, further comprising:

means for rotating and translating the cutting elements and the non-cutting elements after cutting the tubular member.

42. The system of claim 40, wherein means for positioning the cutting elements and non-cutting elements within the tubular member comprises:

spacing apart the cutting elements from the non-cutting elements in an axial direction.

43. The system of claim 40, wherein means for rotating and translating the cutting elements and the non-cutting elements until the cutting elements engage the tubular member comprises:

means for moving the cutting elements towards the non-cutting elements in an axial direction; and

means for displacing the cutting elements and the non-cutting elements outwardly in a radial direction.

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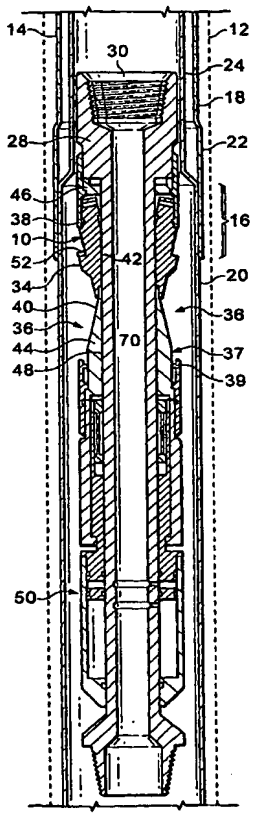
(54) Title: CUTTER FOR WELLBORE CASING



(57) Abstract: A cutter (10) for a wellbore casing (20) is provided that includes a rotatable tubular support (28), at least one cutter blade (34) supported on the rotatable tubular support, having a retracted position for insertion into the wellbore casing and having an expanded position for cutting engagement with the wellbore casing, and an actuator (50) for moving the cutter blade from the retracted position to the expanded position for cutting engagement with the wellbore casing.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

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US CL : 166/298, 55.8, 361

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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,150,755 A (Cassel et al) 29 September 1992, Figs 2-4, col, 4, line 19-col. 6, line 41.	1, 2, 10, 12-14, 16, 17
X	US 4,938,291 A (Lynde et al.), 3 July 1990, Figs 1, 2, col. 4, line 41-col. 5, line 42.	1, 2, 10, 12-14, 16, 17
X	US 5,242,017 A (Hailey) 7 September 1993, Fig. 1, col 2, line 55-col. 3, line 28.	1, 2, 10, 12-14, 16, 17
X,E	US 6,679,328 B2 (Davis et al) 20 January 2004, Figs 1, 2, 5, 8, 9, col. 3, line 33-col. 7, line 5.	1-18

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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